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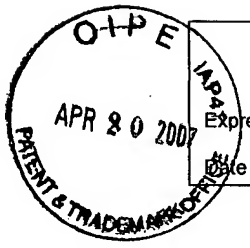

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: Robert M. Setbacken et al.

Appln. No.: 10/829,546

Examiner: Monbleau, Davienne N.

Filed: April 22, 2004

Art Unit: 2878

For: POSITIONAL ENCODER ASSEMBLY

Attorney Docket No: 8371/13

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

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Respectfully submitted,

April 20, 2007
Date

John C. Freeman (Reg. No. 34,483)

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Our Case No. 8371/13

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application:	
Robert M. Setbacken et al.	Examiner: Monbleau, Davienne N.
Serial No.: 10/829,546	Group Art Unit No. 2878
Filed: April 22, 2004	
For: POSITIONAL ENCODER ASSEMBLY	

APPEAL BRIEF

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Commissioner for Patents
P.O. Box 1450
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Dear Sir:

This Appeal Brief is in response to the non-Final Office Action mailed November 21, 2006[1].

[1] One or more of the claims of the present application have twice been rejected and so an appeal of their rejections is proper under 35 U.S.C. § 134(a). Appellants filed a Notice of Appeal and a Pre-Appeal Brief Request for Review concurrently on February 21, 2007. On March 14, 2007, a Notice of Panel Decision from Pre-Appeal Review was mailed indicating the application should proceed to the Board of Patent Appeals and Interferences. Since the Notice of Appeal was filed within three months of the mailing date of the Office Action and the present Appeal Brief is being filed within two months of the receipt date of February 21, 2007 for the Notice of Appeal, the present Appeal Brief is timely filed.

I. REAL PARTY IN INTEREST

Renco Encoders, Inc. and Dr. Johannes Heidenhain GmbH are the real parties of interest in this Appeal. Regarding Renco Encoders, Inc., it is a party of interest pursuant to a recorded assignment of the above-identified application to Renco Encoders, Inc. executed by the inventors of record. Regarding Dr. Johannes Heidenhain GmbH, it is a party of interest in that Renco Encoders, Inc. is a wholly owned subsidiary of Dr. Johannes Heidenhain GmbH.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals, interferences or other judicial proceedings that may be related to, would directly affect or be directly affected by or have a bearing on the Board's decision in the pending Appeal.

III. STATUS OF CLAIMS

Claims 1-14 and 27-47, all claims presented, are rejected and appealed. Claims 15-26 have been canceled. No claims are allowed, withdrawn or objected to.

IV. STATUS OF AMENDMENTS

No Amendment After Final under 37 C.F.R. § 1.116 was filed regarding the Final Office Action mailed on July 12, 2006. Accordingly, there is no unentered amendment.

V. SUMMARY OF CLAIMED SUBJECT MATTER

An understanding of the invention of independent claims 1, 27 and 37 can be made upon a review of the embodiments of the invention shown in FIGS. 1-13 of the specification. Note that in the description to follow, like elements will employ identical identification numerals.

As shown in Fig. 1, the positional encoder assembly 10 includes an optical support structure 12 and a lead frame assembly 14 that are conjoined as discussed below (¶ 0033, ll. 1-3). A circuit board assembly 16 and a code disk 18 are disposed about an axle 24 that is coupled to a motor 22 (¶ 0033, ll. 3-4). As shown in Fig. 2, the optical support structure 12 includes a support structure body 28 having at least one projection 30.1, 30.2 (¶ 0034, ll. 1-3). As shown in Fig. 6, the optical support structure 12 is connected to the lead frame assembly 14, which is disposed directly on the circuit board assembly 16 (¶ 0041, ll. 1-4). The optical support structure 12 includes the support structure body 28 within which the optic 32 is located (¶ 0042, ll. 1-2). As shown in Fig. 3, the lead frame assembly 14 includes a lead frame 34 defining a cavity 40 for receiving a lead frame contact 38 and a sensor 36 (¶ 0035, ll. 1-3). As shown in Fig. 9(b), the lead frame assembly 14 has a stepped profile near its perimeter and has a maximum height E (¶ 0035, ll. 3-5). Thus, the cavity has a stepped shape as well that defines a top opening that is located a distance E above the circuit board assembly 16 (¶ 0035, ll. 5-6). As shown in Figs. 3-6, the lead frame assembly 14 includes the lead

frame 34 defining both the sensor cavity 40 and the LED cavity 47 (¶ 0043, ll. 1-2). The lead frame contact 38 is disposed on the lead frame 34 within the volume defined by the cavity 40 (¶ 0043, ll. 2-4). The sensor 36 is layered directly on the lead frame contact 38 (¶ 0043, l. 4). As shown in Fig. 9(b), the sensor 36 is disposed at a predetermined elevation H above the circuit board assembly 16 (¶ 0050, ll. 1-2).

As shown in Figs. 3 and 9, the sensor 36 is disposed within a lower portion of the cavity 40 and is centered therein so as to be a distance I from the side interior wall of a cylindrical portion (¶ 0036, ll. 4-6). A portion of the sensor 36 is adjacent to a set of external connector pads 42.1-42.10 that are coupled to the circuit board assembly 16 via a set of external connectors 44.1-44-10 (¶ 0037, ll. 1-2). As shown in Fig. 9(b), the external connector 44.1 is disposed a distance A above the surface of the circuit board assembly 16 (¶ 0049, ll. 1-2). The external connectors 44.1-44.10 are bonded to the circuit board assembly 16 by solder deposits 56.1- 56.10, as shown in Fig. 8 (¶ 0046, ll. 6-9). As shown in Figure 9(b), the tops of the connector pads 42.1-42.10 are level with an inner portion 101 of the level frame 34 and are positioned a distance C above the circuit board assembly 16 (¶ 0037, ll. 2-5).

As shown in Fig. 7, the sensor 36 is connected to the set of external connector pads 42.1, 42.10 by a corresponding set of wire bonds 58.1, 58.10 (¶ 0046, ll. 1-2). The bonds 58 preferably rise a maximum distance D above the circuit board assembly 16 as shown in Fig. 9(b) (¶ 0056, ll. 3-4). Note that having the external connectors 44.1-44.10 and the lead frame contact 38 being supported slightly above the circuit board assembly

16 so that the cavity 40 and the lead frame 34, not the leads 54, will define the final elevation of the assembly 10 (¶ 0046, ll. 9-12). In addition, the cavity 40 has a height that is above the maximum height of the wire bonds 58.1, 58.10 as shown in Fig. 9(b). Furthermore, the external connector pads 42.1, 42.10 are at least as high above the circuit board assembly 16 as a top surface of the sensor 36 as shown in Fig. 9(b).

As shown in Figs. 3 and 4(a), the lead frame 34 further includes recesses 46.1, 46.2 for receiving the projections 30.1, 30.2 of the optical support structure 12 described above (¶ 0038, ll. 1-3). As shown in Fig. 3, a light emitting diode (LED) hollow 47 is disposed between the recesses 46.1, 46.2 and adjacent to the cavity 40 (¶ 0039, ll. 1-2). As shown in Fig. 6, hollow 47 lies above cavity 40. As shown in Figs. 3 and 11, disposed within the LED hollow 47 are an LED contact pad 48, an LED bond pad 52 disposed thereon and a light source, such as an LED 50, as shown in Fig. 12 (¶ 0039, ll. 2-4 and ¶ 0044, ll. 1-3). As shown in Fig. 12, the pads 48, 52 have portions 108.1, 108.2, respectively, that extend past the lead frame 34 and function as external connector pads (¶ 0044, ll. 3-5). The contact pad 48 has an internal portion that lies upon the lead frame 34 so as to be aligned within the volume defined by the LED cavity 47 and has the LED 50 supported thereon (¶ 0044, ll. 6-8). The LED 50 is connected to LED bond pad 52 via a connecting wire 57 (¶ 0044, 7-8).

As shown in Fig. 5, the optical support structure 12 is connected to the lead frame assembly 14 by using projections 30.1, 30.2 (Figs. 2 and 4(a)-(b)) as alignment guides by aligning them with recesses 46.1, 46.2 (Figs. 3 and 4(a)) and inserting the

projections within the recesses (¶ 0040, ll. 1-5).

With the above summary in mind, claim 1 claims the invention as a positional encoder assembly that includes a light source to generate an optical signal and an optical support structure housing a refractive optic to direct the optical signal, the optical support structure defining a projection. An example of such a light source and optical support structure are the LED 50 and the optical support structure 12 that includes projections 30.1, 30.2 (¶ 0034, ll. 1-3 and ¶ 0039, ll. 1-4). The claimed positional encoder assembly includes a lead frame defining a cavity, a hollow within which the light source is disposed, and at least one recess to receive the projection. An example of such a lead frame is lead frame 34 that defines cavity 40, hollow 47 for LED 50 and recesses 46.1, 46.2 that receive projections (¶ 0035, ll. 1-3, ¶ 0039, ll. 1-4 and ¶ 0040, ll. 2-5). The claimed positional encoder assembly further includes a sensor disposed within the cavity and adapted to generate an electrical signal in response to the optical signal, the electrical signal distributed to a circuit board assembly; wherein the lead frame is disposed on the circuit board assembly such that the sensor is disposed at a predetermined elevation with respect to the circuit board assembly. An example of such a sensor is sensor 36 that is disposed at the predetermined elevation H above circuit board assembly 16 as shown in Fig. 9(b) (¶ 0050, ll. 1-2).

Claim 27 claims the invention as a positional encoder assembly that includes a light source to generate an optical signal and a circuit board assembly. An example of such a light source and circuit board assembly are the LED 50 and the circuit board

assembly 16 (¶ 0033, ll. 3-4 and ¶ 0039, ll. 1-4). The claimed positional encoder assembly includes a lead frame supported upon the circuit board assembly and defining a first cavity and a hollow within which the light source is disposed. An example of such a lead frame is lead frame 34 that defines recesses 46.1, 46.2 and hollow 47 for LED 50 (¶ 0039, ll. 1-4). The claimed positional encoder assembly includes a connector positioned above the circuit board assembly and located externally to the lead frame and a connector pad positioned within a second cavity defined by the lead frame and electrically connected to the connector. An example of such a connector and connector pad are connector 44.1 and connector pad 42.1 positioned within cavity 40 (Fig. 9(b), ¶ 0037, ll. 1-2). The claimed positional encoder assembly further includes a sensor disposed within the second cavity supported upon a lead frame contact and adapted to generate an electrical signal in response to the optical signal, the electrical signal distributed to a wire bond that is located within the second cavity and is in electrical contact with the connector pad so that the electrical signal is distributed to the connector and the circuit board assembly; wherein the second cavity has a height that is above a maximum height of the wire bond and the connector pad is at least as high above the circuit board assembly as a top surface of the sensor. Examples of such a lead frame contact and wire bond are lead frame contact 38 and wire bonds 58 (¶ 0035, ll. 1-3 and ¶ 0046, ll. 1-2). An example of the recited relationship between elements is shown in Fig. 9(b).

Claim 37 claims the invention as a positional encoder assembly that includes a

light source to generate an optical signal and a circuit board assembly. An example of such a light source and circuit board assembly are the LED 50 and the circuit board assembly 16 (¶ 0033, ll. 3-4 and ¶ 0039, ll. 1-4). The claimed positional encoder assembly includes a lead frame supported upon the circuit board assembly and defining a first cavity within which the light source is disposed. An example of such a lead frame is lead frame 34 that defines hollow 47 for LED 50 (¶ 0039, ll. 1-4). The claimed positional encoder assembly includes a connector positioned above the circuit board assembly and located externally to the lead frame and a connector pad positioned within a second cavity defined by the lead frame and electrically connected to the connector. An example of such a connector and connector pad are connector 44.1 and connector pad 42.1 positioned within cavity 40 (Fig. 9(b), ¶ 0037, ll. 1-2). The claimed positional encoder assembly further includes a sensor disposed within the second cavity supported upon a contact and adapted to generate an electrical signal in response to the optical signal, the electrical signal distributed to a wire bond that is in located within the second cavity and is in electrical contact with the connector pad so that the electrical signal is distributed to the connector and the circuit board assembly; wherein the second cavity lies below the first cavity. Examples of such a contact and wire bond are lead frame contact 38 and wire bonds 58 (¶ 0035, ll. 1-3 and ¶ 0046, ll. 1-2). An example of the recited relationship between elements is shown in Fig. 9(b).

Regarding only independent claims 1, 27 and 37 and dependent claims 2, 7, 10, 29, 30, 33, 39, 40 and 47, which are argued separately below in Section VII, there are

no means-plus-function terms or step-plus-function terms present therein. This statement is not to be construed as an admission whether or not the remaining claims contain means-plus-function terms or step-plus-function terms.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The three rejections presented for review: 1) claims 1, 3-6, 11-14, 27, 28, 34-38 and 44-46 as being obvious under 35 U.S.C. § 103(a) in view of Okumura et al., U.S. Patent No. 6,803,560, and Leong et al., U.S. Patent No. 7,045,775, 2) claims 7-10, 30-33, 40-43 and 47 as being obvious under 35 U.S.C. § 103(a) in view of Okumura et al., Leong et al. and Chin et al., U.S. Patent Application Publication No. US 2003/0193016 and 3) claims 2, 29 and 39 as being obvious under 35 U.S.C. § 103(a) in view of Okumura et al., Leong et al. and Franklin et al., U.S. Patent No. 6,727,493.

VII. ARGUMENT

A. Okumura et al. and Leong et al.

1. Claims 1, 3-6, 11-14 and 46

Claims 1, 3-6, 11-14 and 46 were rejected in the Office Action of November 21, 2006 (hereinafter "the Office Action") under 35 U.S.C. § 103 as being obvious in view of Okumura et al. and Leong et al. Appellants traverse the rejection for several reasons. First, Leong et al. is directed to non-analogous art. The test for non-analogous art is two fold: 1) whether the reference is within the inventors' field of endeavor; and 2) if the

reference is not within the inventors' field of endeavor, whether the reference is reasonably pertinent to the particular problems in which the inventors are involved. *In re GPAC Inc.*, 57 F.3d 1573, 1578, 35 USPQ2d 1116, 1120 (Fed. Cir. 1995). Regarding the first test, the field of endeavor of the claimed invention is the field of positional encoder assemblies. Leong et al. fails the first test since it regards an optical navigation sensor (Col. 1, ll. 11-14). Regarding the second test, Appellants are concerned with providing improved performance and reliability for positional encoder assemblies by providing an exact height of the sensor above a circuit board assembly as explained in detail in paragraphs 0004 and 0009 of Appellants' Specification. Leong et al. fails the second test since it is directed to a structure for preventing foreign matter from entering an aperture of an optical navigation sensor (Col. 2, ll. 24-36). Since Leong et al. fails both of the tests for analogous art, the rejection is improper and should be reversed.

Assuming for argument's sake that Leong et al. is directed to analogous art, the rejection is still improper. Independent claim 1 recites a positional encoder assembly "wherein the lead frame is disposed on the circuit board assembly such that the sensor is disposed at a predetermined elevation with respect to the circuit board assembly." The Examiner at page 3 of the Office Action asserts that it would have been obvious to apply Leong et al.'s snap feature 74 to Okumura et al.'s housing 8 to fix it to a frame of Okumura et al. Appellants do not see the relevance of such a combination since claim 1 recites that the lead frame is disposed on a circuit board and the Examiner has

conceded at page 3 of the Office Action that Okumura et al. does not disclose a lead frame disposed on a circuit board.

The Examiner further asserts at pages 3-4 of the Office Action that it would have been obvious to use a lead frame disposed on a circuit board in Okumura et al.'s device in the manner disclosed with respect to Leong et al.'s housing 60. However, Leong does not disclose such a lead frame. As shown in FIG. 3 of Leong et al., the housing 60 is inserted through a planar structure (denoted by vertical lines) and placed on a planar support. The planar support is not a circuit board because it is denoted by diagonal lines instead of the vertical lines of the circuit board 52 of Leong et al. Assuming for the sake of argument only that the planar structure (denoted by vertical lines in FIG. 3) is a circuit board, the fact remains that the housing 60 is not disposed on the planar structure in the manner recited in claim 1. Instead, housing 60 is disposed through the planar structure. Since there is no suggestion in Leong et al. to have housing 60 disposed on a circuit board, the rejection is improper.

The rejection is improper for the additional reason that Leong et al. does not disclose nor suggest a sensor "disposed at a predetermined elevation with respect to the circuit board assembly" as recited in claim 1. As shown in FIGS. 3-4 of Leong et al., the contacts 68 pass through a circuit board. The circuit board is not constrained as to where it engages the contacts 68 relative to the die 62. Accordingly, the die 62 is not a predetermined elevation with respect to the circuit board as required by claim 1.

For the above reasons, the rejection of claim 1 is improper and should be

reversed. Claims 3-6, 11-14 and 46 depend directly or indirectly on claim 1 and so their rejections should be reversed for the same reasons stated above with respect to claim 1.

2. **Claims 27, 28, 34-38, 44 and 45**

Claims 27, 28, 34-38, 44 and 45 were rejected in the Office Action under 35 U.S.C. § 103 as being obvious in view of Okumura et al. and Leong et al. Appellants traverse the rejection for several reasons. First, Leong et al. is directed to non-analogous art as pointed out above at pages 9-10 of Section VII.A.1. Second, independent claims 27 and 37 each recites a positional encoder assembly that includes a lead frame supported upon a circuit board assembly. As pointed out above at pages 10-11 of Section VII.A.1, Leong et al. does not disclose nor suggest altering Okumura et al. to have a lead frame supported upon a circuit board assembly.

For the above reasons, the rejections of claims 27 and 37 are improper and should be reversed. Claims 28, 34-36, 38, 44 and 45 depend directly or indirectly on either claim 27 or claim 37 and so their rejections should be reversed for the same reasons stated above with respect to claims 27 and 37.

B. **Okumura et al., Leong et al. and Chin et al.**

Claims 7-10, 30-33, 40-43 and 47 are rejected under 35 U.S.C. § 103 as being obvious in view of Okumura et al., Leong et al. and Chin et al. Appellants traverse the rejection in that Leong et al. is directed to non-analogous art as pointed out above at pages 9-10 of Section VII.A.1.

The rejection is improper for the additional reason that claims 7, 10, 30, 33, 40, 43 and 47 depend directly or indirectly on either claim 1, claim 27 or claim 37 which recite a positional encoder assembly that has either 1) "the lead frame is disposed on the circuit board assembly such that the sensor is disposed at a predetermined elevation with respect to the circuit board assembly" (claim 1) or 2) a lead frame supported upon a circuit board assembly (claims 27 and 37). As pointed out above at pages 10-12 of Sections VII.A.1-2, Leong et al. does not suggest altering Okumura et al. to dispose a lead frame on a circuit board assembly in the manner recited in claims 1, 27 and 37. Chin et al. does not overcome the deficiencies of Leong et al. since it does not suggest disposing a lead frame on a circuit board assembly. This was pointed out in Appellants' Amendment of May 23, 2006 and Pre-Appeal Brief filed on October 12, 2006 and essentially conceded with the Notice of Panel Decision from Pre-Appeal Brief Review mailed on November 21, 2006 and the new arguments/rejections based on Chin et al. contained in the Office Action.

For the above reasons, the rejections of claims 7, 10, 30, 33, 40, 43 and 47 are improper and should be reversed. Claims 8, 9, 31, 32, 41 and 42 depend directly or indirectly on either claim 7, 30, 40 or 47 and so their rejections should be reversed for the same reasons stated above with respect to claims 7, 30, 40 and 47.

C. <u>Okumura et al., Leong et al. and Franklin et al.</u>

Claims 2, 29 and 39 are rejected under 35 U.S.C. § 103 as being obvious in view of Okumura et al., Leong et al. and Franklin et al. Appellants traverse the rejection in

that Leong et al. is directed to non-analogous art as pointed out above at pages 9-10 of Section VII.A.1.

The rejection is improper for the additional reason that claims 2, 29 and 39 depend directly on either claim 1, claim 27 or claim 37 which recite a positional encoder assembly that has either 1) "the lead frame is disposed on the circuit board assembly such that the sensor is disposed at a predetermined elevation with respect to the circuit board assembly" (claim 1) or 2) a lead frame supported upon a circuit board assembly (claims 27 and 37). As pointed out above at pages 10-12 of Sections VII.A.1-2, Leong et al. does not suggest altering Okumura et al. to dispose a lead frame on a circuit board assembly in the manner recited in claims 1, 27 and 37. Franklin et al. does not overcome the deficiencies of Leong et al. since it does not suggest disposing a lead frame on a circuit board assembly. This was pointed out in Appellants' Amendment of May 23, 2006 and Pre-Appeal Brief filed on filed on October 12, 2006 and essentially conceded with the Notice of Panel Decision from Pre-Appeal Brief Review mailed on November 21, 2006 and the new arguments/rejections based on Chin et al. contained in the Office Action.

For the reasons give above, Appellants respectfully submit that the rejections should be reversed and the claims should be allowed.

Respectfully submitted,

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Dated: April 20, 2007

VIII. CLAIMS APPENDIX

1. A positional encoder assembly comprising:

a light source to generate an optical signal;

an optical support structure housing a refractive optic to direct the optical signal, the optical support structure defining a projection;

a lead frame defining a cavity, a hollow within which the light source is disposed, and at least one recess to receive the projection; and

a sensor disposed within the cavity and adapted to generate an electrical signal in response to the optical signal, the electrical signal distributed to a circuit board assembly; wherein the lead frame is disposed on the circuit board assembly such that the sensor is disposed at a predetermined elevation with respect to the circuit board assembly.

2. The positional encoder assembly of claim 1, wherein the sensor is an integrated OPTO-ASIC sensor.

3. The positional encoder assembly of claim 1, further comprising a lead frame contact disposed beneath the sensor.

4. The positional encoder assembly of claim 1, further comprising an external connector protruding from the lead frame, the external connector connectable to the circuit board assembly.

5. The positional encoder assembly of claim 4, further comprising an external connector pad coupled to the external connector.

6. The positional encoder assembly of claim 5, further comprising a wire bond connectable between the sensor and the external connector pad.

7. The positional encoder assembly of claim 1, further comprising an optically transparent encapsulant layer disposed on the sensor.

8. The positional encoder assembly of claim 47, wherein the optically transparent encapsulant layer encapsulates the sensor, the wire bond, and the external connector pad.

9. The positional encoder assembly of claim 7, wherein the optically transparent encapsulant layer is contained within the cavity of the lead frame.

10. The positional encoder assembly of claim 1, further comprising a code disk disposed between the optical support structure and the lead frame.

11. The positional encoder assembly of claim 1, wherein the refractive optic is a prismatic lens.

12. The positional encoder assembly of claim 1, wherein the predetermined elevation is between 0.7 and 1.0 millimeters.

13. The positional encoder assembly of claim 1, wherein the light source is disposed at a second predetermined elevation with respect to the circuit board assembly.

14. The positional encoder assembly of claim 1, wherein the light source is disposed at a second predetermined elevation with respect to the circuit board assembly, and further wherein the second predetermined elevation is greater than the

predetermined elevation.

27. A positional encoder assembly comprising:

a light source to generate an optical signal;

a circuit board assembly;

a lead frame supported upon the circuit board assembly, the lead frame defining a first cavity and a hollow within which the light source is disposed;

a connector positioned above the circuit board assembly and located externally to the lead frame;

a connector pad positioned within a second cavity defined by the lead frame and is electrically connected to the connector;

a sensor disposed within the second cavity supported upon a lead frame contact and adapted to generate an electrical signal in response to the optical signal, the electrical signal distributed to a wire bond that is located within the second cavity and is in electrical contact with the connector pad so that the electrical signal is distributed to the connector and the circuit board assembly; wherein the second cavity has a height that is above a maximum height of the wire bond and the connector pad is at least as high above the circuit board assembly as a top surface of the sensor.

28. The positional encoder assembly of claim 27, further comprising:

an optical support structure housing a refractive optic to direct the optical signal, the optical support structure defining a projection;

the lead frame defining at least one recess to receive the projection in a

snap fit fashion.

29. The positional encoder assembly of claim 27, wherein the sensor is an integrated OPTO-ASIC sensor.

30. The positional encoder assembly of claim 27, further comprising an optically transparent encapsulant layer disposed on the sensor.

31. The positional encoder assembly of claim 30, wherein the optically transparent encapsulant layer encapsulates the sensor, the wire bond, and the connector pad.

32. The positional encoder assembly of claim 30, wherein the optically transparent encapsulant layer is contained within the second cavity of the lead frame.

33. The positional encoder assembly of claim 27, further comprising a code disk disposed between the optical support structure and the lead frame.

34. The positional encoder assembly of claim 28, wherein the refractive optic is a prismatic lens.

35. The positional encoder assembly of claim 27, wherein the light source is disposed at a second predetermined elevation with respect to the circuit board assembly, and further wherein the second predetermined elevation is greater than the first predetermined elevation.

36. The positional encoder assembly of claim 27, wherein the light source lies above the lead frame contact.

37. A positional encoder assembly comprising:

a light source to generate an optical signal;

a circuit board assembly;

a lead frame supported upon the circuit board assembly, the lead frame defining a first cavity within which the light source is disposed;

a connector positioned above the circuit board assembly and located externally to the lead frame;

a connector pad positioned within a second cavity defined by the lead frame and is electrically connected to the connector;

a sensor disposed within the second cavity supported upon a contact and adapted to generate an electrical signal in response to the optical signal, the electrical signal distributed to a wire bond that is located within the second cavity and is in electrical contact with the connector pad so that the electrical signal is distributed to the connector and the circuit board assembly; wherein the second cavity lies below the first cavity.

38. The positional encoder assembly of claim 37, further comprising:

an optical support structure housing a refractive optic to direct the optical signal, the optical support structure defining a projection;

the lead frame defining at least one recess to receive the projection in a snap fit fashion.

39. The positional encoder assembly of claim 37, wherein the sensor is an integrated OPTO-ASIC sensor.

40. The positional encoder assembly of claim 37, further comprising an optically transparent encapsulant layer disposed on the sensor.

41. The positional encoder assembly of claim 40, wherein the optically transparent encapsulant layer encapsulates the sensor, the wire bond, and the connector pad.

42. The positional encoder assembly of claim 40, wherein the optically transparent encapsulant layer is contained within the second cavity of the lead frame.

43. The positional encoder assembly of claim 37, further comprising a code disk disposed between the optical support structure and the lead frame.

44. The positional encoder assembly of claim 38, wherein the refractive optic is a prismatic lens.

45. The positional encoder assembly of claim 37, wherein the light source is disposed at a second predetermined elevation with respect to the circuit board assembly, and further wherein the second predetermined elevation is greater than the first predetermined elevation.

46. The positional encoder assembly of claim 27, wherein the light source lies above the lead frame contact.

47. The positional encoder assembly of claim 6, further comprising an optically transparent encapsulant layer disposed on the sensor.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.